

**Monitoring Plan for Wetland Compensatory Mitigation for  
Magnuson Park Phase 2 Development  
Seattle, Washington**

**COE #200600052**

*Prepared for:*



*Prepared by:*



**February 9, 2006**

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Seattle, Washington**

**COE #200600052**

***Prepared for:***

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## 1.0 INTRODUCTION

The City of Seattle Parks and Recreation Department (Seattle DPD) acquired Warren G. Magnuson Park in 1972. In the decades that followed, Seattle DPD went through the public Master Planning process several times. More recently, Seattle DPD has undergone an extensive public review process to design improvements in Magnuson Park. This public review process resulted in the creation of the Master Plan for Future Development (Seattle Parks and Recreation, 2001). The Master Plan was approved by the Parks Board and City Council in June 14, 2004 (Council Bill # 114827).

The 2004 Master Plan included the creation of: 11 lighted, synthetic turf, athletic fields; a natural grass sports meadow; and improvements to on-site habitats within the Park, including wetlands. As a result of various political and environmental review processes, the total number of proposed athletic fields has been reduced. The final Master Plan approved the Sports Meadow and up to 9 athletic fields, 7 of which may be lighted.

The 2004 Master Plan identified multiple Phases of work to complete all elements of the Plan. Phase 1 included the Sports Meadow which was constructed in 2004-05, and will be in use in 2006. The proposed Phase 2 action will occur on an approximately 95-acre portion of Magnuson Park. The proposed action includes creating athletic fields and their associated infrastructure (e.g. stormwater conveyance facilities). The proposed action also incorporates creating and enhancing wetland habitats, and enhancing upland habitats. The proposed action does not include creation of any additional impervious surfaces.

The Conceptual Wetland Compensation Plan for Magnuson Park (Sheldon & Associates, January, 2006) was prepared as part of the JARPA permit package for submittal to the U.S. Army Corps of Engineers, Washington State Department of Ecology, and the City of Seattle. The purpose of the Wetland Compensation Plan was to address compensation for the anticipated wetland impacts from Phase 2 actions in the Park. The Wetland Compensation Plan includes a Monitoring Section. At the request of the Seattle City Council, a stand-alone Monitoring and Adaptive Management Plan was prepared to identify actions for 3 years. The permitting agencies require 10 years of monitoring, which is the standard used in this Monitoring Plan.

Phase 2 development will impact 6.0 acres of wetlands by filling and by the associated changes in hydroperiod. As specified in the Conceptual Wetland Compensation Plan (Sheldon & Associates, 2006), it is proposed to create just over 10 acres of new wetland and enhance just over 4 acres of existing wetlands in the Phase 2 project area to compensate for those anticipated impacts. The compensation will include removing approximately 12 acres of impervious surface and treating stormwater runoff from some paved surfaces which is currently untreated. The compensation will also provide improved access for educational purposes.

Except for one Category IV wetland, all existing wetlands within the Phase 2 project area are Category III (Ecology/City of Seattle rating systems) (Sheldon & Associates, 2005). The majority of the wetlands are closed depressions, dominated by native and non-native grasses and forbs with some patches of native shrub and sapling/forest communities. The wetlands in the Phase 2 project area have a seasonal hydroperiod, becoming shallowly inundated by winter rains and drying out completely by late spring of each year. Due to severely compacted soils on the site, it is assumed that no groundwater infiltration or groundwater movement between wetlands occurs in existing conditions.

This Monitoring Plan provides the following:

- an outline of the goals, objectives, and performance standards specified in the Conceptual Wetland Compensation Plan (Sheldon & Associates, 2006);
- a monitoring plan for the habitat areas within Phase 2;
- schedule for monitoring events;
- reporting schedule; and
- proposed adaptive management responses to monitoring results.

Wetlands within Magnuson Park are subject to City, State and Federal regulations. Copies of the Conceptual Wetland Compensation Plan (Sheldon & Associates, 2006) have been provided to: Seattle Department of Planning and Development (Seattle DPD); Washington State Department of Ecology (Ecology); and the Army Corps of Engineers (COE). As mentioned above, the Conceptual Wetland Compensation Plan included a Monitoring Section, and this Monitoring Plan is a stand-alone document prepared at the request of the Seattle City Council. It is assumed that adoption of the Conceptual Wetland Compensation Plan will be a requirement for the Phase 2 project permits from the regulatory agencies.

## **2.0 GOALS, OBJECTIVES and PERFORMANCE STANDARDS**

The goals for any compensation plan outline what is expected and anticipated for the project over time. The objectives describe how the goals are to be achieved. The performance standards are the ‘measuring sticks’ used to determine if the goals are being met, or if conditions are in place to ensure that the goals will be met over time. Each performance standard should be linked back to one more of the goals. Goals are, by definition, broadly described expectations. Objectives are the actions necessary to directly achieve the goals or to implement the conditions that are necessary to achieve the goals. Performance standards are precise and quantifiable measurements of the objectives, and are tied to a time frame to ensure that actions lead to the desired outcomes within a pragmatic and effective period.

Described below are the goals and objectives for the habitat parameters of the Phase 2 action. Following those are the Performance Standards.

### **2.1 Goals and Objectives**

The goals for the habitat parameters of the proposed project are:

- to preserve the hydroperiod of existing wetlands that are to remain unaltered on the site, and maintain the general movement of water across the site;
- enhance the functions of some of the wetlands within the project area through passive and active means such as increasing the depth/duration of hydroperiods, increasing native species richness, removing and controlling invasives, increasing physical complexity, and improving conditions in adjacent habitats;
- maintain or improve the physical connectivity between habitats on the site;
- create new wetlands with a diversity of vegetative communities and HGM-types out of existing low-quality upland habitats;
- improve water quality conditions of runoff draining into Lake Washington by removing 12 acres of impervious surface and appropriately treating stormwater runoff from some paved surfaces which is untreated under existing conditions;
- provide improved access for education and passive interpretation of the various habitats and water features in the project area.

**Goal #1: Preserve hydroperiod of remaining wetlands and water movement across the site.**

- Objective 1.1: Analyze the existing sub-basins of the project area and ensure that future conditions will replicate existing water movement patterns across the site;
- Objective 1.2: Design the grading of the site to ensure that unaltered wetlands will retain an appropriate source of water to maintain a hydroperiod that will sustain the existing or proposed vegetation communities;
- Objective 1.3: Design the movement of water across the site so that general patterns will be maintained and that water exiting the project area will replicate existing conditions.

**Goal #2: Enhance the functions of wetlands and uplands to remain in the project area.**

- Objective 2.1: Passively increase the duration and depth of inundation of some existing wetlands through means such as back-watering or increased volume of input to shift the hydroperiod to support a community of more wet-tolerant native plant species;
- Objective 2.2: Actively change the hydroperiod of existing wetlands through shallow to moderate grading to create areas of deeper inundation for longer duration to improve native vegetation conditions;
- Objective 2.3: Improve native species richness, diversity, and physical complexity by seeding and installing native species in all habitat types to be enhanced. Installation methods include seeding, plugs, live stakes, bare-root or potted emergents, shrubs, or trees. Choose species based on the appropriate successional stage of the community (*e.g.*, under-plant existing shrub/sapling zones with later seral stage coniferous species);
- Objective 2.4: Remove and control non-native plants (invasives and non-invasive species) through physical removal and active management, changes in hydroperiod to create inappropriate growth conditions, and/or over-planting of native species;
- Objective 2.5: Create physical complexity on the forest floor for habitat improvements through placement of LWD, brush piles, and rock piles in all habitat types within the Phase 2 area;
- Objective 2.6: Reduce the numbers and locations of informal foot paths throughout the habitat zone of the Phase 2 area to reduce human and dog contact with habitats.
- Objective 2.7: Provide habitat for wildlife and invertebrate species within the habitat zone of the Phase 2 project area, with an emphasis placed on bird species, amphibian species, and aquatic benthic invertebrates

**Goal #3: Improve habitat linkages within the Project Area and adjacent habitats**

- Objective 3.1: Maintain, to the extent feasible, all the groves of existing native shrubs, saplings and trees within the Project Area;
- Objective 3.2: Create upland forest habitat around the perimeter zones of the Project Area to link the interior habitats with existing upland habitats outside of the limits of the Phase 2 project area;
- Objectives 3.3: Provide physical complexity on the forest floor with LWD, brush piles, rock piles within all the terrestrial habitats for wildlife refuge;
- Objective 3.4: Under-plant existing closed canopy treed communities with appropriate later seral stage woody species to facilitate successional stages.

#### **Goal #4: Create new wetlands from low-quality upland habitats**

- Objective 4.1: Remove the roots and/or root mass of non-native invasives such as Himalayan blackberry, Scotch broom, and reed canary-grass to improve long-term success of establishing appropriate plant communities;
- Objective 4.2: Create wetland hydroperiods by grading to form zones of long-term inundation at depths that will promote the growth of obligate wetland plant species;
- Objective 4.3: Create saturated soil conditions by creating zones of long-term saturation through inundation and/or capillary fringe actions in amended soils to promote the growth of wetland shrubs and trees;
- Objective 4.4: Install native seeds, plugs, shrubs, saplings, and live stakes in areas of appropriate wetland hydroperiods to create diverse communities of native species;
- Objective 4.5: Create physical complexity on the forest floor through placement of LWD, brush piles and rock piles throughout the created wetland areas.

#### **Goal #5: Improve water quality of runoff discharged into Lake Washington**

- Objective 5.1: Remove 12 acres of impervious surface in the Phase 2 project area;
- Objective 5.2: Provide appropriate state-of-the-art pre-treatment for portions of the existing untreated stormwater currently being discharged to Lake Washington;
- Objective 5.3: Daylight an existing buried storm-drain pipe, pre-treat the stormwater, and then run it through over 2,000 linear feet of created and enhanced wetland habitats prior to discharging to an existing storm-drain pipe leading to Lake Washington.

#### **Goal #6: Create the infrastructure for active and passive education opportunities**

- Objective 6.1: Design the trail system to allow for ease of access to a variety of upland and aquatic habitats for viewing, data collection, over-views, and observing wildlife;
- Objective 6.2: Provide appropriate locations for students of multiple ages to have ready access to a range of aquatic features and stormwater treatment-trains for collecting water samples;
- Objective 6.3: Design the trail system that provides ADA access to a broad range of habitat types, including elevated locations for over-views, without creating human intrusions into all habitats in the Phase 2 project area.

## **2.2 Performance Standards**

Performance standards are tools that are used to determine if goals are being met, or if the parameters are in place for goals to be met over time. The most recent mitigation guidance document from Ecology/COE/EPA (2004) states:

*“Performance standards describe a desired state, threshold value, or amount of change necessary to indicate that a particular function is being performed or structure has been established.”*

From a practical standpoint, performance standards have to be correlated to the stated goals of a project in order to evaluate whether the project is achieving its stated goals. Performance Standards must also define the indicators to be measured and set a time frame for establishment of the mitigation plan. In general, measurable indicators include vegetation, water or evidence of water, physical structures or conditions, and/or infrastructure. The following Performance Standards are organized relative to the Goals and Objectives outlined above. It is assumed that monitoring will occur on-site for 10 years post-construction.

Based on correlating performance standards to goals and objectives, one can trace what physical indicators or actions are proposed to implement and eventually obtain the Goals. Because of this organizational approach, the Performance Standards contain a certain amount of repetition for various vegetation community types, and even between uplands and wetland habitats. Plant species are assumed to be those listed in Table 7 of the Conceptual Wetland Compensation Plan (Sheldon & Associates, 2006).

Table 11 of the Conceptual Wetland Compensation Plan (Sheldon & Associates, 2006) organized the Performance Standards according to the specific goals and objectives that they were designed to measure. In this document, the Performance Standards are organized according to 8 monitoring parameters to simplify monitoring data collection. In addition, this document slightly expands upon the information provided in the Performance Standards and Monitoring sections of the Conceptual Wetland Compensation Plan. It is important to note that the goals, objectives, and overall performance standards specified in the Conceptual Wetland Compensation Plan have not changed.

Table 1, below, lists the 8 monitoring parameters and summarizes how those parameters relate to the Goals and Objectives listed above. Following Table 1 are 8 Performance Standards Tables (A-G) that clearly define the following for each of the 8 monitoring parameters:

- The habitat area being monitored.
- The performance standards for that parameter in that habitat area.
- The monitoring activity that is take place to collect the data.
- The schedule of the monitoring.
- The adaptive management response to the data collected, if one is triggered.

In addition, there is one additional Table (H) that describes the monitoring parameters for special one-time data collection events. These actions are related to construction activities and/or placement of new infrastructures that will be documented once, and do not require continuous monitoring for 10 years.

Prior to Tables A-H is a list of the assumptions for the Performance Standards.

#### **PERFORMANCE STANDARDS ASSUMPTIONS:**

##### Water Regimes:

- Areas with permanent standing water deeper than 5 feet will not be vegetated.
- Areas with seasonal inundation of a few inches to 18 inches that fully dry out every year by mid-spring will not become a monoculture of cattails.
- Areas within 1 foot of the elevation of long-term or permanent inundation will develop soil saturation within the top 12 inches from the action of capillary fringe.
- Areas that are inundated or saturated for more than 12.5 percent (30 consecutive days) of the growing season (between March 1 and October 31) will, over time, develop wetland soil characteristics.

##### Vegetation Structure Development:

- Live stakes will be planted at higher densities than rooted plants, and will not be held to specific percent survival performance standards, because a higher mortality is assumed. Percent aerial cover performance standards for tree and shrub live-stakes are provided.
- Bare root or containerized trees and shrubs plant material will have a 100% survival within the first



year if they are bid with a one-year guarantee period.

- Trees and shrubs will be planted in naturalistic mixed clusters with 2-3 species of trees and 4-6 species of shrubs in each cluster. For species richness determination, at least 2 species of trees and 4-5 species of shrubs will remain/establish within the community within the first 3 years. Appropriate volunteer species can be included in this assessment.
- In forested and shrub communities, depending on the installation density, tree and shrub aerial coverage should be 20-50% by Year 3, 50-70% by Year 5, and greater than 70% by Year 7.
- For species diversity determination, no single species should constitute more than 50% of the total aerial coverage after 3 years. The exception would be a purposeful pioneering species such as red alder (*Alnus rubra*) used to establish appropriate early seral stage conditions.
- Appropriate native volunteer species can be counted for determination of species richness.
- Emergent plants will be installed by seeding rather than live plants, except in zones where no grading is proposed and passive backwatering is to be used to change the hydroperiod: plugs will be used in those settings.
- Emergent species richness should consist of at least four species including appropriate native volunteer species after Year 3, with a total 45-60% aerial coverage.
- No 'forest' will develop in 10 years; installed trees will be in shrub sapling stages.

Non-native Invasive Species:

- Woody non-native invasive species such as Scotch broom (*Cytisus scoparius*), and both Himalayan and evergreen blackberry (*Rubus armeniacus* and *R. laciniatus*) will be assumed to be 'controllable' and a standard of 100% removal within the Phase 2 project area by year 5.
- Non-native herbaceous invasives which are rhizomatous or are spread by seed (e.g., reed canary-grass, *Phalaris arundinacea*) do not have a 100% removal goal in five years due to the high probability that such a standard is unachievable. Reed canary-grass root masses will be removed by grading or will be over-planted with native shrubs and trees, and are expected to diminish over time.

**Table 1. Goals and Objectives Addressed by Monitoring Parameters**

<b>Monitoring Parameter</b>	<b>Goals Addressed</b>	<b>Objectives Addressed</b>
Hydrology	2, 4	2.1, 2.2, 4.2, 4.3
Water Quality	5	5.2, 5.3
Vegetation	2, 3, 4	2.3, 3.2, 3.4, 4.4
Invasives	2, 4	2.4, 4.1
Condition and Composition of Existing Groves	3	3.1
Conditions of Informal Trails, Barriers, and Signage	2	2.6
Wildlife Use and Condition of Habitat Structures	2, 3, 4	2.5, 3.3, 4.5
Birds, Amphibians, Macroinvertebrates	2	2.7
<i>Special One-Time Monitoring Events</i>		
Site Grading	1	1.3
Removal of Impervious Surfaces	5	5.1
Construction of the New Trail	6	6.1
Construction of Educational Access Sites on New Trail	6	6.2
Construction of ADA Access on the New Trail	6	6.3

**Performance Standards Table A. Hydrology Performance Standards**

Habitat Area	Performance Standards	Monitoring Activity	Monitoring Schedule	Adaptive Management Responses
Enhanced Wetlands designed to have inundation and saturation from passive backwatering	<ul style="list-style-type: none"> <li>Create a minimum of 12 inches of inundation for a minimum of 5 consecutive months/year in years of normal precipitation levels.</li> </ul>	Measure Staff Gauges	Once/month December 1 – June 1; Years 1, 2, 3, 5, 7, 10.	<ul style="list-style-type: none"> <li>Increase depths of inundation by raising outlets.</li> <li>Diminish permeability of leaky berms or other non-fixed outlets.</li> </ul>
	<ul style="list-style-type: none"> <li>Create saturated soils within 12 inches of the surface for a minimum of 5 consecutive months/year in years of normal precipitation levels.</li> </ul>	Measure Piezometers		
Enhanced Wetlands designed to have inundation and saturation by grading	<ul style="list-style-type: none"> <li>Create impounded water levels of a minimum of 16 inches for a minimum of 5 consecutive months/year in years of normal precipitation levels.</li> </ul>	Measure Staff Gauges		<ul style="list-style-type: none"> <li>Deepen the excavation to increase depths of inundation.</li> <li>Restrict size of outlets to increase volume of retention and prolong inundation.</li> </ul>
	<ul style="list-style-type: none"> <li>Create saturated soils within 12 inches of the surface for a minimum of 5 consecutive months/year in years of normal precipitation levels.</li> </ul>	Measure Piezometers		
Created Wetlands designed to have inundation and saturation	<ul style="list-style-type: none"> <li>Create impounded water levels of a minimum of 16 inches for a minimum of 5 consecutive months/year in years of normal precipitation levels.</li> </ul>	Measure Staff Gauges		<ul style="list-style-type: none"> <li>Deepen the excavation to increase depths of inundation.</li> <li>Restrict size of outlets to increase volume of retention.</li> </ul>
	<ul style="list-style-type: none"> <li>Create saturated soils within 12 inches of the surface for a minimum of 5 consecutive months/year in years of normal precipitation levels.</li> </ul>	Measure Piezometers		<ul style="list-style-type: none"> <li>Add organic soil to facilitate capillary action.</li> <li>Modify wetland outlet to prolong adjacent inundation.</li> </ul>

**Performance Standards Table B. Water Quality Performance Standards**

Habitat Area	Performance Standards	Monitoring Activity	Monitoring Schedule	Adaptive Management Responses
Enhanced Wetlands designed to have inundation and saturation from passive backwatering	<ul style="list-style-type: none"> <li>Provide appropriate pre-treatment for portions of the existing untreated stormwater currently being discharged to Lake Washington</li> <li>Pre-treat stormwater, and then run it through over 2,000 linear feet of created and enhanced wetland habitats prior to discharging to an existing storm-drain pipe leading to Lake Washington</li> </ul>	<ul style="list-style-type: none"> <li>Grab samples at appropriate water discharge sites</li> <li>Grab samples at appropriate sites in the enhanced wetlands</li> </ul>	Once/month for November 1 – May 31; Years 1, 2, 3, 5, 7, 10.	<p>According to 2005 Seattle Parks and Recreation BMP's for Turf Management, fertilizer, herbicides and pesticides are not likely to be a component of water discharged from natural grass playing fields.</p> <ul style="list-style-type: none"> <li>If used, alter fertilization and herbicide application on natural turf fields.</li> <li>Extend time period that water is retained within wetlands.</li> <li>Alter hydrological regimen for recharging wetlands.</li> </ul>
Enhanced Wetlands designed to have inundation and saturation by grading		<ul style="list-style-type: none"> <li>Grab samples at appropriate water discharge sites</li> <li>Grab samples at appropriate sites in the enhanced wetlands</li> </ul>		
Created Wetlands designed to have inundation and saturation		<ul style="list-style-type: none"> <li>Grab samples at appropriate water discharge sites</li> <li>Grab samples at appropriate sites in the created wetlands</li> </ul>		

**Performance Standards Table C. Vegetative Performance Standards.**

**Monitoring Schedule for all Habitat Areas: Once/year by August 1 in Years 1, 2, 3, 5, 7, and 10**

Document with photographs from permanent photo points during all monitoring events.

Habitat Area	Performance Standards		Monitoring Activity	Adaptive Management Responses	
WETLANDS: Created and Enhanced.	EMERGENTS	<ul style="list-style-type: none"><li>No one species will constitute more than 50% presence in the wetland.</li><li>By Year 3, a minimum of 4 species per community will be present which can include appropriate native spp.</li><li>By Year 3, there will be 45-60% emergent aerial cover, including desirable native spp.</li></ul>	In 1 meter plots measure: <ul style="list-style-type: none"><li>% aerial cover by species Years 1, 2, 3, 5, 7, 10</li></ul> In whole wetland measure: <ul style="list-style-type: none"><li>species composition and note spp. with <math>\geq 50\%</math> aerial cover Years 1, 2, 3, 5, 7, 10</li></ul>	<ul style="list-style-type: none"><li>Determine causes of species failure.</li><li>Install plug, seed, live stake, bare-root or potted material (as appropriate) of additional plants. May substitute other hydrologically appropriate species.</li><li>Increase management of invasives or competitive species.</li><li>Provide temporary irrigation during establishment period.</li><li>Provide herbivory protection. Possibilities include: netting for emergents; and rodent collars or fencing for trees and shrubs.</li></ul>	
	SHRUBS: live stakes	<ul style="list-style-type: none"><li>At a minimum % aerial cover will be: 25% by year 3, 50% by year 5, and &gt;70% by year 7.</li><li>Plants should be vigorous beginning in Year 1.</li></ul>			
	SHRUBS: live stakes planted @ shading density	<ul style="list-style-type: none"><li>At a minimum % aerial cover will be: &gt;50% by year 3 and &gt;70% by year 5.</li></ul>			
	SHRUBS: potted or bareroot	<ul style="list-style-type: none"><li>A minimum of 80% survival of installed plants for Years 1 and 2.</li><li>% aerial cover should be at least: 25% by year 3, 50% by year 5, and &gt;70% by year 7.</li><li>By Year 3, planting clusters will have a minimum of 4 shrub spp including desirable native spp.</li><li>Plants should be vigorous.</li></ul>			In 5 meter plots measure: <ul style="list-style-type: none"><li>% survival Years 1 &amp; 2 (except for live-stakes);</li><li>% aerial cover and vigor by species Years 3, 5, 7, 10</li></ul>
	SHRUBS: potted or bareroot planted @ shading density	<ul style="list-style-type: none"><li>A minimum of 80% survival of installed plants for Years 1 and 2.</li><li>At a minimum % aerial cover will be: &gt;50% by year 3 and &gt;70% by year 5</li><li>Richness parameter is absent as function is to provide vigorous competitive growth for canopy closure goal</li></ul>			

**Performance Standards Table C Continued. Vegetation Performance Standards.**

**Monitoring Schedule: Once/year by August 1 in Years 1, 2, 3, 5, 7, 10**

Document with photographs from permanent photo points during all monitoring events.

Habitat Area	Performance Standards		Monitoring Activity	Adaptive Management Responses
WETLANDS: Created and Enhanced.	TREES: live stakes	<ul style="list-style-type: none"><li>At a minimum % aerial cover will be: 25% by year 3, 50% by year 5, and &gt;70% by year 7.</li><li>Plants should be vigorous.</li></ul>	In 10 meter plots measure: <ul style="list-style-type: none"><li>% survival Years 1 &amp; 2, except live-stakes;</li><li>% aerial cover and vigor by species Years 3, 5, 7, 10</li></ul>	<ul style="list-style-type: none"><li>Determine causes of species failure.</li><li>Install plug, seed, live stake, bare-root or potted material (as appropriate) of additional plants. May substitute other hydrologically appropriate species.</li><li>Increase management of invasives or competitive species.</li><li>Provide temporary irrigation during establishment period.</li><li>Provide herbivory protection. Possibilities include rodent collars or fencing for trees and shrubs.</li><li>In upland areas, add or increase mulch depth for trees and shrubs.</li></ul>
	TREES: live stakes @ shading density			
	TREES: potted or bareroot	<ul style="list-style-type: none"><li>At least 80% survival of installed plants for Years 1&amp;2.</li><li>% aerial cover should be: 20-30% by year 3, 50-60% by year 5, and &gt;70% by year 7.</li><li>By Year 3, planting clusters will have a minimum of 2 tree spp., not including desirable native spp.</li><li>Plants should be vigorous.</li></ul>		
	TREES: pot or bareroot planted @ shading density			
UPLANDS: Buffers (Created and Enhanced Wetlands); Created Forest Areas	SHRUBS: potted or bareroot	<ul style="list-style-type: none"><li>At least 80% survival of installed plants for Years 1&amp;2.</li><li>% aerial cover should be at least: 25% by year 3, 50% by year 5, and &gt;70% by year 7.</li><li>By Year 3, planting clusters will have a minimum of 2 tree spp. not including desirable native spp.</li><li>Plants should be vigorous.</li></ul>	In 5 meter plots measure: <ul style="list-style-type: none"><li>% survival Years 1 &amp; 2;</li><li>% aerial cover and vigor by species Years 3, 5, 7, 10</li></ul>	
	TREES: potted or bareroot	<ul style="list-style-type: none"><li>At least 80% survival of installed plants for Years 1&amp;2.</li><li>% aerial cover should be: 20-30% by year 3, 50-60% by year 5, and &gt;70% by year 7.</li><li>By Year 3, planting clusters will have a minimum of 2 tree spp. not including desirable native spp.</li><li>Plants should be vigorous.</li></ul>	In 10 meter plots measure: <ul style="list-style-type: none"><li>% survival Years 1 &amp; 2;</li><li>% aerial cover and vigor by species Years 3, 5, 7, 10</li></ul>	
CONIFER Under-planting of Existing Forest Areas	TREES: potted or bareroot installed by the end of Year 4.	<ul style="list-style-type: none"><li>Survival of 80% of installed plants by 3 years post-installation.</li><li>Plants should be vigorous.</li></ul>	In 10 meter plots measure: <ul style="list-style-type: none"><li>% survival Years 1, 2 and 3 post-installation;</li><li>vigor by species Years 3, 5, 7, 10</li></ul>	

**Performance Standards Table D. Non-native Invasive Species Performance Standards.**  
**Performance Standards Apply to the Entire Phase 2 Project Area.**

Performance Standards	Monitoring Activity	Monitoring Schedule	Adaptive Management Responses
<p>Removal and effective control of non-native invasive species to the following Performance Standards:</p> <ul style="list-style-type: none"> <li>• <u>Lombardy poplar (<i>Populus nigra</i>)</u>: 100% removal by end of Year 2 in the Phase 2 project area.</li> <li>• <u>Himalayan and evergreen blackberries (<i>Rubus armeniacus</i> and <i>R. laciniatus</i>)</u>: 100% removal by Year 3 in the Phase 2 project area.</li> <li>• <u>Scotch broom (<i>Cytisus scoparius</i>)</u>: 100% removal by Year 3 in the Phase 2 project area.</li> <li>• <u>Japanese knotweed and hybrids (<i>Polygonum cuspidatum</i>, <i>P. bohemicum</i>, <i>P. sachalinense</i>)</u>: 100% removal by Year 3 in the Phase 2 project area.</li> <li>• <u>Reed canary-grass (<i>Phalaris arundinacea</i>)</u>: installation of native species at high densities (over-planting) in the planting areas of the Phase 2 project area with RCG by Year 2. Reduction in vigor and stem density of RCG in areas of over-planting by Year 5.</li> </ul>	<p>The entire Phase 2 project area will be monitored for all managed non-native invasive species:</p> <ul style="list-style-type: none"> <li>• Patches will be identified and located in as-builts or at Year 1 monitoring.</li> <li>• Monitoring plots will focus on the existing or former invasive patches. Plots will include the entire patch. Patches will be monitored to watch for re-sprouting or recolonization of managed species.</li> <li>• Document with photographs from permanent photo points.</li> </ul>	<p>For all managed invasives:</p> <ul style="list-style-type: none"> <li>• Twice/year Years 1, 2, and 3. Early growing season (prior to June 30) and late growing season (by August 30) to ensure that rapid maintenance actions can be undertaken to remove/control invasives.</li> <li>• Years 5, 7, 10 (spring/summer) monitoring may be reduced to once/year depending upon presence of invasives.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased monitoring frequency to allow faster maintenance action response time.</li> <li>• Re-grubbing of roots, re-application of sheet mulch, and/or re-application of wood chips.</li> <li>• Increased frequency of stem injection of Japanese knotweed</li> <li>• Active mowing between clumps/rows of woody plants to reduce above-ground stock of reed canary grass.</li> </ul>

**Performance Standards Table E. Performance Standards for Existing Groves and Informal Trails.**  
**Performance Standards Apply to the Entire Phase 2 Project Area.**

<b>Monitoring Parameter</b>	<b>Performance Standards</b>	<b>Monitoring Activity</b>	<b>Monitoring Schedule</b>	<b>Adaptive Management Responses</b>
Existing Stands and Groves of Trees	<ul style="list-style-type: none"> <li>Maintain the extent and improve the species composition of existing groves of trees and saplings within the Phase 2 Project Area that are designated for monitoring by under-planting with late seral stage conifer saplings.</li> </ul>	<ul style="list-style-type: none"> <li>Document locations, approximate boundaries, general conditions and composition of existing groves of trees and saplings within the Project Area that are designated for monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>Groves will be identified and located in as-builts drawings or at Year 1 monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>Groves will be augmented or replanted if they are damaged during site construction.</li> </ul>
		<ul style="list-style-type: none"> <li>Document with photographs from permanent photo points.</li> <li>Document the sizes, species composition, and general conditions of the groves.</li> </ul>	<ul style="list-style-type: none"> <li>Once/year coincide with annual vegetation monitoring for Years 1, 2, and 3.</li> </ul>	
Informal Trails	<ul style="list-style-type: none"> <li>Block access, eliminate, and post informational signage on all informal trails through the habitat area that are noted for removal, by end of Year 2 of construction.</li> </ul>	<ul style="list-style-type: none"> <li>Confirm condition of barriers, informational signage, and trail conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Once/year coincides with annual vegetation monitoring for Years 1, 2, 3, 5, 7, 10.</li> </ul>	<ul style="list-style-type: none"> <li>Reinstall effective barriers;</li> <li>Post additional signage</li> <li>Deconstruct trails through ripping of soils and replanting with un-inviting plant (e.g. wild rose).</li> </ul>



**Performance Standards Table F. Performance Standards for Wildlife Use and Condition of Habitat Structures.**  
**Performance Standards Apply to the Entire Phase 2 Area.**

Performance Standards	Monitoring Activity	Monitoring Schedule	Adaptive Management Responses
<ul style="list-style-type: none"> <li>At the completion of installation, there will be an average of 4 –6 habitat structures per acre in habitat areas of the Phase 2 project area.</li> <li>Habitat structures may include brush piles, LWD, and/or rock piles.</li> <li>Brush piles should be a minimum of approximately 5x5 feet wide and 3-4 feet high at installation.</li> <li>LWD will be no less than 8” diameter at the smallest end, and no less than 3 feet long.</li> <li>Rock piles will be no smaller than 3x3 feet wide and average of 2 feet high. Rocks should be an average of 4-6 inches minimum in ‘diameter’ with the intent to form a pile with substantial spacing between/underneath rocks for refuge.</li> </ul>	<ul style="list-style-type: none"> <li>Document the location and approximate dimensions of brush piles, LWD, and rock piles in the As-builts. Note presence, dimensions, locations, and provide photo-documentation in the baseline/as-built report..</li> </ul>	<ul style="list-style-type: none"> <li>Identify and locate Habitat Structures in As-Built drawings.</li> </ul>	<ul style="list-style-type: none"> <li>Augment brush piles with additions if they become too compressed or diminished over time.</li> <li>Add additional pieces of LWD if ones are too decomposed or use indicates need for more;</li> <li>Replenish rock piles or remove invasives (blackberry) which may establish in them.</li> </ul>
	<ul style="list-style-type: none"> <li>Note evidence of use (trails in/out, scat, droppings, grazing, observed perching activity, etc.) of habitat structures.</li> <li>Observe and document with photographs, the dimensions and conditions of habitat structures.</li> </ul>	<ul style="list-style-type: none"> <li>Once/year coincide with annual vegetation monitoring for Years 1, 2, 3, 5, 7, 10.</li> </ul>	

**Performance Standards Table G. Performance Standards for Birds, Amphibians, and Aquatic Macroinvertebrates**

<b>Animal/Habitat Area</b>	<b>Performance Standards</b>	<b>Monitoring Activity</b>	<b>Monitoring Schedule</b>	<b>Adaptive Management Responses</b>
<b>BIRDS</b> All habitats associated with Phase 2 of the project	<ul style="list-style-type: none"> <li>No specific performance standard in place for birds</li> </ul>	<ul style="list-style-type: none"> <li>Christmas bird count</li> </ul>	<ul style="list-style-type: none"> <li>Once/year for bird counts.</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
		<ul style="list-style-type: none"> <li>Monthly bird species tallies</li> </ul>	<ul style="list-style-type: none"> <li>Once/month for species richness Years 1, 2, 3, 5, 7, 10.</li> </ul>	
<b>AMPHIBIANS</b> All Monitored Wetland Areas in Phase 2 project area AND Frog Pond.	<ul style="list-style-type: none"> <li>Amphibian populations in Frog Pond, adjacent to Phase 2, will not show declines.</li> </ul>	<ul style="list-style-type: none"> <li>Frog-Watch qualitative data from volunteers during breeding season</li> </ul>	<ul style="list-style-type: none"> <li>Once/week from January through July, every year.</li> </ul>	<ul style="list-style-type: none"> <li>Inoculation of larval amphibians into appropriate habitat.</li> <li>Establishment of appropriate aquatic plant community to facilitate amphibian survival and reproduction.</li> </ul>
		<ul style="list-style-type: none"> <li>Egg mass counts during breeding season</li> </ul>	<ul style="list-style-type: none"> <li>Once/month from January through May, every year.</li> </ul>	
		<ul style="list-style-type: none"> <li>Adult/larval counts</li> </ul>	<ul style="list-style-type: none"> <li>Once/month from March through July, every year.</li> </ul>	
<b>MACROINVERTEBRATES</b> All Monitored Wetland Areas in Phase 2 project area.	<ul style="list-style-type: none"> <li>Macroinvertebrates: Index of Biological Integrity falls within an appropriate reference range.</li> </ul>	<ul style="list-style-type: none"> <li>Dip net sweeps</li> </ul>	<ul style="list-style-type: none"> <li>Once/month from March through September, every year.</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of appropriate aquatic plant community to facilitate macroinvertebrate survival and reproduction.</li> </ul>
		<ul style="list-style-type: none"> <li>Dendy plate larval collections</li> </ul>	<ul style="list-style-type: none"> <li>Once/year, during a three week period in June.</li> </ul>	

**Performance Standards Table H. Performance Standards for Special One-Time Monitoring Events.**

Events are expected to occur once at the completion of construction.

<b>Monitoring Parameter</b>	<b>Performance Standards</b>	<b>Monitoring Activity</b>	<b>Monitoring Schedule</b>	<b>Adaptive Management Responses</b>
Site Grading	<ul style="list-style-type: none"> <li>Maintain generalized pattern of water movement across the site in pre-existing conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Examination of as-builts to confirm that site grading reflects approved designs.</li> <li>Document construction modifications with change-order approvals from design ecologist and agency staff.</li> </ul>	Completion of grading of Phase 2 project area.	<ul style="list-style-type: none"> <li>Modify grades and elevations as necessary to achieve appropriate water movement and control erosion.</li> <li>Document construction modifications with change-order approvals from design ecologist and agency staff.</li> </ul>
Removal of Impervious Surfaces	<ul style="list-style-type: none"> <li>Remove 12 acres of existing impervious surfaces from the Phase 2 project area and dispose of the material appropriately off-site.</li> </ul>	<ul style="list-style-type: none"> <li>Document removal of materials in As-Builts and include photographs in annual monitoring report.</li> </ul>	At end of demolition stage of construction.	<ul style="list-style-type: none"> <li>If not possible to complete all at once, remove materials in stages and document % removal to agencies.</li> </ul>
Construction of the New Trail for access that also maintains habitat exclusions	<ul style="list-style-type: none"> <li>Trail is completed that allows adequate pedestrian movement.</li> <li>New trail eliminates informal portions of existing trails and maintains portions of the habitat zones as 'trail-free'.</li> </ul>	<ul style="list-style-type: none"> <li>Document trail completion in As-Builts.</li> <li>Document with photographs of site conditions and include in annual monitoring report.</li> </ul>	At completion of construction activities.	<ul style="list-style-type: none"> <li>If necessary, construct New Trail in phases, and remove old trails in phases.</li> </ul>
Construction of Educational Access Sites on the New Trail	<ul style="list-style-type: none"> <li>Appropriate active education access sites and nodes are located on the Trail such that students can access water and various habitat types in a manner that does not cause damage to habitat functions or water quality.</li> </ul>	<ul style="list-style-type: none"> <li>Document in As-Builts</li> <li>Document with photographs of site conditions and include in first monitoring report following completion of construction activities.</li> </ul>	At completion of construction activities.	<ul style="list-style-type: none"> <li>If necessary, construct active education access sites on the New Trail in phases.</li> </ul>
Construction of ADA Access on the New Trail	<ul style="list-style-type: none"> <li>The portions of trail designed to meet state and federal ADA standards are located to access water and habitats appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>Document in As-Builts</li> <li>Document with photographs of site conditions and include in annual monitoring report.</li> </ul>	At completion of construction activities.	<ul style="list-style-type: none"> <li>If necessary, phase construction of access sites which meet ADA standards on the New Trail.</li> </ul>

### 3.0 MONITORING PLAN

The monitoring plan is the tool by which data is collected to determine if the goals are being met as measured by the performance standards. The monitoring program uses the principles of adaptive management to guide monitoring activities. Adaptive management is a process with two key components (Elzinga *et al.* 1998). One component is that monitoring should only be initiated if opportunities for management change exist. The second component is that monitoring is driven by stated objectives, and that monitoring activities must be designed to determine if the objectives have been achieved. Valid monitoring data is critical to making meaningful management decisions to help meet mitigation objectives. Monitoring plans are based on site conditions, plant community development, and other measurable characteristics.

The Performance Standards listed in Tables A-H above will be used as the basis for monitoring. Tables A-H also provide monitoring schedules and summaries of monitoring activities. Monitoring methods that should be used to ensure valid data collection for plant survival, vegetation coverage, photo-points, water regime, and wildlife use are described below.

Monitoring events include a wide range of activities, some of which are appropriate for participation by volunteers. To ensure consistency and technical accuracy, many of the monitoring methodologies require professional expertise, or professional oversight of trained volunteers. This is due to the skills and/or training necessary to use the methodologies, and to ensure consistency of data collection from year to year. However, for activities that are appropriate for volunteer participation, the City has identified those monitoring events that can create authentic hands-on stewardship opportunities. Those opportunities are outlined in Table 2 below which is an overview of allocation of monitoring activities. Tables 3, 4 and 5 below provide calendars for the monitoring activities.

#### 3.1 As-Built Drawings and Baseline Monitoring Report

As-Built drawings will be prepared at the end of the construction and installation of the Phase 2 project. The As-Built drawings will form the basis of the Baseline monitoring report, which will be handed in prior to Dec. 1 of the year construction is completed. Construction may take two summer seasons, depending upon the start date. As-Built drawings will contain a topographic survey of the project area, including the constructed infrastructure such as trails, storm catch-basins, athletic fields, and weirs. All habitat areas will be surveyed (based on topography) to determine the final size of created and enhanced areas. Staff gauges and piezometer elevations will be surveyed, as well as the locations of permanent photo-points and vegetation monitoring plots for long-term monitoring. Locations of habitat structures (*e.g.*, brush piles, rock piles, LWD) will also be surveyed.

The baseline monitoring report will contain plant installation notes which include: quantities list; species list; size and condition of plant materials (*e.g.*, bare root, container, plug, seed); and locations and timing of installation. The baseline monitoring report will also include separate lists of plant quantities, size/condition and species installed in each specific habitat/planting area.

**Table 2. Allocation of Monitoring Activities**

<b>Monitoring Parameter</b>	<b>Task to be done by Professionals</b>	<b>Task to be done by Trained Volunteers with Oversight by Professionals</b>	<b>Task to be done by Trained Volunteers</b>
Hydrology: data collection	X	X	
Water Quality: sample grabs		X	X
Vegetation	X	X	
Invasives	X	X	
Condition and Composition of Existing Groves		X	X
Conditions of Informal Trails, Barriers, and Signage		X	X
Wildlife Use and Condition of Habitat Structures	X	X	
Birds			X
Amphibians Egg Mass Monitoring		X	X
Amphibians Larval/Adult Sampling	X	X	
Amphibians Frog Call Assessment			X
Macroinvertebrates Dip Net Sweeps	X	X	
Macroinvertebrates Dendy Plate Sampling	X	X	
<i>Special One-Time Monitoring</i>			
Site Grading	X		
Removal of Impervious Surfaces	X		
Construction of the New Trail	X		
Construction of Educational Access Sites on New Trail	X		
Construction of ADA Access on the New Trail	X		

**Table 3. Monitoring Calendar for Hydrology, Water Quality, Vegetation, Invasives and Trails.**

<b>Monitoring Parameter</b>	<b>Jan.</b>	<b>Feb.</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug.</b>	<b>Sept.</b>	<b>Oct.</b>	<b>Nov.</b>	<b>Dec.</b>
<u>Hydrology</u> measure once/month in Years: 1, 2, 3, 5, 7, 10	X	X	X	X	X							X
<u>Water Quality</u> measure once/month in Years: 1, 2, 3, 5, 7, 10	X	X	X	X	X						X	X
<u>Vegetation</u> measure once/year in Years: 1, 2, 3, 5, 7, 10							X					
<u>Invasives</u> measure twice/year in Years: 1, 2, and 3						X		X				
<u>Invasives</u> measure once/year (depending on presence) in Years: 5, 7, 10							X					
<u>Condition and Composition of Existing Groves</u> measure once/year in Years: 1, 2, and 3							X					
<u>Conditions of Informal Trails, Barriers, and Signage</u> measure once/year in Years: 1, 2, 3, 5, 7, 10							X					

**Table 4. Monitoring Calendar for Wildlife and Habitat Structures.**

<b>Monitoring Parameter</b>	<b>Jan.</b>	<b>Feb.</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug.</b>	<b>Sept.</b>	<b>Oct.</b>	<b>Nov.</b>	<b>Dec.</b>
<u>Wildlife use and condition of</u> <u>Habitat Structures</u> observe once/year in Years: 1, 2, 3, 5, 7, 10							X					
<u>Birds</u> <u>Christmas Bird Count</u> once/year: in all Years <u>Informal Bird Count by</u> <u>Audubon Society</u> once/month: in all Years	X	X	X	X	X	X	X	X	X	X	X	X
<u>Amphibians</u> <u>Egg Mass Monitoring</u> once/month: in all Years	X	X	X	X								
<u>Amphibians</u> <u>Larval/Adult Sampling</u> once/month: in all Years			X	X	X	X	X					
<u>Amphibians</u> <u>Frog Call Assessment by</u> <u>Frog-Watch Volunteers</u> once/week: in all Years	X	X	X	X	X	X	X					
<u>Macroinvertebrates</u> <u>Dip Net Sweeps</u> once/month: in all Years			X	X	X	X	X	X	X			
<u>Macroinvertebrates</u> <u>Dendy Plate Sampling</u> 3 weeks in June: in all Years						X						

**Table 5. Monitoring Calendar for Special One-Time Monitoring Events**

Events are expected to occur once at the completion of construction.

Monitoring Parameter	Monitor at Completion of Construction
Site Grading	X
Removal of Impervious Surfaces	X
Construction of the New Trail	X
Construction of Educational Access Sites on the New Trail	X
Construction of ADA Access on the New Trail	X

### 3.2 Monitoring Parameters

Refer to Tables A-H for specific Performance Standards and adaptive management responses.

#### **Hydrology**

To document the hydroperiod of the created and enhanced wetlands after construction in Phase 2 project area, data will be collected from staff gauges and piezometers installed during construction. Under existing conditions, the soils are so compacted that very little infiltration occurs on the site. Water movement across the site is predominantly by sheet and shallow surface flow. For that reason, piezometers have not been installed on the site to establish baseline conditions. Staff gauges will be installed in created and enhanced wetlands that will have a permanent or seasonally inundated surface water component. In addition, piezometers will be installed in zones around the margins of those wetlands to document whether the saturation within the soils is sufficient to meet the performance standards.

Hydrology data will be collected on a monthly basis from December through May of Years 1, 2, 3, 5, 7, and 10. Given the conditions of the site and the elements incorporated into the Phase 2 design to dampen water level fluctuations between storm events, it is deemed unnecessary to install continuous-reading gauges or to collect field data more frequently. Precipitation data will be obtained from NOAA which is located immediately north of Magnuson Park. On-site hydrology data will be correlated to precipitation data on a water-year basis, and will be included in the annual monitoring reports.

#### **Water Quality**

According to the 2005 BMP's for Turf Management, the Seattle Department of Parks and Recreation does not apply fertilizer in the immediate vicinity of wetlands, or within 50 feet of shorelines. 2005 BMP's also include Integrated Pest Management protocols which specify that turf pests (including weeds, insects and diseases) in athletic fields are generally controlled through good turf cultural practices rather than by the use of herbicides and pesticides. As a result, fertilizer, herbicides and pesticides are not likely to be a component of water discharged from natural grass playing fields.

Monthly water samples will be taken at appropriate sites established within the Phase 2 project area; samples will be collected from November 1 through May 31 during Years 1, 2, 3, 5, 7, and 10. Sample sites



will be established at water discharge points into and out of created and enhanced wetlands, and discharge points from the athletic fields. Grab sampling will be done at these established points by volunteers, overseen by a professional hydrologist. All samples will be analyzed by an appropriate professional laboratory, with appropriate quality assurance/quality control measures in place. Water quality parameters to be monitored include: total phosphorus levels; total nitrogen compound levels; dissolved oxygen; total suspended solids; fecal coliform bacterial counts; water temperature; and water pH. All measured parameters will be compared to acute and chronic Aquatic Life Standards for Washington State, where appropriate. Adaptive management strategies include altering herbicide and pesticide application to athletic fields, altering residence times of water within the wetlands, and altering hydrological regimens associated with the wetlands.

### **Vegetation**

Vegetation data will be collected from a variety of matrices. Given the highly variable survival rate for live stakes and the higher planting densities, vigor and percent aerial cover will be used as Performance Standards rather than percent survival. It is a commercial landscaping standard to use 100% survival of installed rooted plant material as a 'performance standard'. Although this standard may be appropriate for 'bank parking lot' landscape installation, it is not reasonable for acres of plants installed in a wide range of habitat and soil conditions. However, because that standard is likely to be expected by reviewers, we have maintained the 100% survival performance standard for those plants that are bid with that provision. For all other rooted plant materials (i.e. container and bare-root), we have used a performance standard of 80% survival after 3 years, which is a reasonable expectation on such a large project.

Beyond survival, plant establishment (as measured by percent aerial cover) is proposed as a major metric for monitoring. Defining the aerial coverage Performance Standards to occur over a time frame are challenging 'guesses', dependent upon conditions of the soils, hydrology, plant health, herbivory, mulch, *etc.* We have provided ranges of aerial coverage for Performance Standards at targeted years (3, 5, 7, and 10) for trees and shrubs. We have included a metric for plant species richness and diversity (the number of species and the relative percent presence of species, respectively). In addition, we will include qualitative assessments of plant vigor, recolonization, grazing or herbivory effects, *etc.* in our assessment of vegetation community health.

As soon as possible after installation, permanent photopoints and a sufficient number of permanent sampling plots to accurately represent the different habitats/planting areas will be established.

#### **Habitats/Planting Areas**

- created and enhanced wetlands;
- upland forested and shrub buffers for wetlands;
- created upland forest;
- enhanced upland forests (under-planting of existing shrub/sapling zones with later seral stage coniferous species).

#### **Sample Plot Sizes**

- Emergent habitats will be monitored in 1 meter plots,
- Shrubs will be monitored in 5 meter plots,
- Trees/saplings will be monitored in 10 meter plots.

Vegetation monitoring will occur in Years 1, 2, 3, 5, 7, and 10. For emergents, percent aerial cover by species by plot, will be measured, and species composition of the whole wetland will be noted. For plants that were installed as livestakes, percent survival will not be estimated due to higher expected mortality, but

percent cover will be estimated beginning in Year 3. For plants that are installed as rooted plants, survival will be estimated (by species by plot) to determine percent survival for Years 1 and 2. For all trees and shrubs, during monitoring Years 3, 5, 7, and 10, percent aerial cover will be measured for: installed species; desirable volunteer native species; and non-native invasive species. In these later years, percent survival will not be monitored.

For all monitoring years, photographs will be taken from the photopoints, and the general condition of all the plants will be noted. Qualitative observations of plants will include: size; new growth (vigor); presence of disease, harmful insects or stressed leaves; evidence of leaf or stem browsing; cloning; *etc.* Dead/dying plants will be noted as well as the probable cause for the loss. If deemed necessary to satisfy the Performance Standards, adaptive management responses as outlined in the Tables above, will be undertaken.

### **Non Native Invasive Species**

Many of the plants that recolonized the Naval Air Station after it was decommissioned were non-native invasive species. Magnuson Park has large impenetrable thickets of Himalayan blackberry (*Rubus armeniacus*); and English hawthorn (*Crataegus monogyna*) and Scotch broom (*Cytisus scoparius*) are pervasive in the upland areas. Reed canary-grass (*Phalaris arundinacea*) is common in many of the wetlands. Lombardy and white poplars (*Populus nigra* and *P. alba*) were planted as ornamentals and have successfully invaded many areas of the Park. Invasive species out-compete native species, and some can form exclusive monocultures.

Eradicating and controlling non-native invasive species in the Phase 2 project area is an important objective of the Phase 2 project. The Performance Standards require 100% control/removal of: Lombardy poplars; Himalayan and evergreen blackberries (*Rubus laciniatus*); Scotch broom; Japanese knotweed and its hybrids (*Polygonum cuspidatum*, *P. bohemicum*, *P. sachalinense*); and a reduction in the presence of reed canary-grass. For long-term management, many of the areas that currently have infestations of invasive species will be grubbed to remove roots, sheet mulched with cardboard (multiple thickness), and mulched with up to 12 inches of wood chip or arborist mulch. These areas will also be densely planted (over-planted) with native trees and shrubs to quickly establish a canopy to shade out the invasives. Reed canary grass areas are proposed to be over-planted in such a manner that active mowing, twice/summer will reduce plant vigor and allow the establishment of a closed canopy by Year 3.

The entire Phase 2 area will be monitored for the non-native invasive species listed above. By design, much of the area that will be graded to create or enhance wetlands currently has large infestations of woody invasives. Large patches of invasives will be identified and located in the As-Built or during Year 1 monitoring. Monitoring plots will focus on existing and former patches of invasives, and will include the entire patch. Plots will be monitored to watch for re-sprouting and/or recolonization of managed species. In Years 1, 2, and 3, when the maximum amount of recolonization is expected, invasive species monitoring will occur a minimum of two times per year. In case the regularly scheduled maintenance actions are not frequent enough to control the invasives, monitoring twice per year will ensure that additional actions can be undertaken in a timely manner. In Years 5, 7, and 10, as long as the Years 1-3 Performance Standards are met, monitoring may be reduced to a minimum of one time per year. If invasive presence exceeds the Performance Standards, adaptive management responses as outlined will be undertaken.

### **Condition and Composition of Existing Groves**

One of the features that the proposed actions of Phase 2 has attempted to preserve at Magnuson Park are the scattered groves and stands of native saplings and trees. To the maximum extent possible, the Phase 2

design has been developed to preserve those groves. However, there are a limited number of groves located adjacent to construction activities which might be damaged. All remaining groves will be monitored for the first three years following construction. The locations and approximate sizes of the grove will be included in the As-Built. At the Year 1 monitoring event, the groves will be characterized (woody species, conditions, *etc.*) and permanent photo-stations which accurately depict the groves will be established. During the vegetation monitoring events of Years 1, 2, and 3, the sizes, species composition, and general conditions of the groves will be noted, and photos will be taken from the photopoints. Groves will be enhanced by under-planting with native saplings. Additional plantings may be augmented or replanted if monitoring results indicate that trees were damaged during site construction.

### **Conditions of Informal Trails, Barriers and Signage**

Magnuson Park is crisscrossed by a network of informal trails. Although Park visitors enjoy using these trails for dog walking and other purposes, these trails serve to fragment habitat and provide an easy access route for the spread of invasive plant species. The presence of people and dogs also has a negative effect on many wildlife species. To improve habitat, access to some of the informal trails in the Phase 2 habitat area will be blocked and the trails will be eliminated. Before the trails are removed, informational signage will be posted on all informal trails that are noted for removal by end of Year 2 of construction.

Monitoring the conditions of the effective closure of informal trails will occur once per year for Years 1, 2, 3, 5, 7, and 10, and will coincide with the annual vegetation monitoring. Monitoring will confirm the conditions of barriers, informational signage, and trail conditions. If monitoring results indicate the need, additional barriers will be installed, additional signage will be posted, and trails will be deconstructed by ripping the soil and replanting with uninviting native species (*e.g.* wild rose, salmonberry, Oregon grape, *etc.*).

### **Wildlife Use and Condition of Habitat Structures**

One of the goals of the Phase 2 plan is to improve wildlife habitat. In addition to removing informal trails, controlling/removing non-native invasive species, and planting native trees and shrubs, it is planned to install habitat structures. Habitat structures include brush piles, large woody debris (LWD), and rock piles. The habitat structures will provide shelter, refuge and perching sites for wildlife. To a certain degree, installing habitat structures is a case of “build it and they will come”.

Locations of the habitat structures will be surveyed and included in the As-Built. Monitoring wildlife use and conditions of the habitat structures will occur once per year for Years 1, 2, 3, 5, 7, and 10, and will coincide with the annual vegetation monitoring. Specific monitoring will occur for some of the more easily observed fauna (*e.g.* birds, amphibians and macroinvertebrates), but because many of the wildlife species at Magnuson Park are either secretive or nocturnal, it is unlikely that they would be observed during monitoring events. Instead, indicators of wildlife use and presence, such as trails in and out of the habitat structures, scat, droppings, grazing, *etc.*, will be monitored. In addition, the dimensions and conditions of habitat structures will be noted and documented with photographs. If deemed necessary to satisfy the Performance Standards, actions to maintain the habitat structures (*i.e.* adding brush or rocks to existing piles, installing additional LWD, *etc.*) will be undertaken.

### **Birds**

Seattle Audubon Society has conducted monthly bird counts in the Park for many many years. It is anticipated that those monthly bird counts will continue and that data, provided by Audubon volunteers, will be included in the annual monitoring reports. It is assumed that bird monitoring by volunteers will continue

and will be performed in Years 1-10. No performance standards have been established for bird species or populations.

### **Amphibians**

Because of the strong public interest at Magnuson Park for the local populations of Pacific chorus frogs, we have included matrices for their breeding in Frog Pond, and in the newly created and enhanced wetlands as a performance standard. One of the objectives of the habitat work is to create and expand viable habitat for a broad range of prey and predator species: chorus frogs are as good an indicator as any for the health of these wetlands over time.

Amphibian monitoring will be conducted using three different techniques. Volunteers will conduct weekly monitoring of calling frogs throughout the Phase 2 project area during the breeding season. Sampling protocol is derived from the U.S. Geological Service/National Wildlife Federation Frog Watch USA protocol, and will allow for a qualitative assessment of breeding populations of Pacific chorus frogs at Magnuson Park. Additional monitoring will be conducted to determine egg mass counts, and larval and adult numbers of Pacific chorus frogs and any other amphibians that occur on site; monitoring will be conducted once per month from January through July. Egg mass counts and larval and adult counts will be conducted by volunteers, and will be overseen by a professional biologist.

### **Macroinvertebrates**

Aquatic invertebrate species and population estimates will be conducted within the enhanced and created wetlands in Magnuson Park. Sampling with aquatic sweep nets will be conducted once per month, from March through August. All samples will be preserved in ethyl alcohol or other appropriate preservative, and identification of organisms to the family level will be done by a professional biologist. Samples will be used to generate benthic indices of biological integrity (B-IBIs), and will be compared to appropriate reference B-IBIs to analyze the health of the wetland systems on site.

Additional collections will be performed once per year in June, using Hester-Dendy sampling plates. Plates will be installed at designated sites within the created and enhanced wetlands, and invertebrates will be allowed to colonize the plates for three weeks. Following this period, plates will be collected and organisms that have colonized the plates will be preserved in ethyl alcohol or other appropriate preservative. Identification of collected organisms to the family level will be done by a professional biologist, and, along with the data from sweep sampling, will be used to generate B-IBIs.

### **Special One-Time Monitoring Events to Occur at Completion of Construction**

Several of the monitoring parameters are expected to require a single monitoring event. Table H summarizes those parameters with the applicable Performance Standards.

**Site Grading:** Phase 2 project goals require that final grading of the Phase 2 project area maintains the existing general pattern of water movement across the site. After completion of grading and preparation of the As-Builts, this parameter will be monitored by examining the As-Builts to determine whether final site grading reflects the approved designs. If not, grades and elevations will be modified as necessary to achieve appropriate water movement and control erosion. All construction modifications will be documented with change-order approvals from the design ecologist and agency staff.

**Removal of Impervious Surfaces:** Phase 2 project objectives include removal and proper disposal of approximately 12 acres of impervious surfaces from the project area. At the end of the demolition stage of

construction, removal of impervious materials will be documented in the As-Builts. Photographs will be included in either the Baseline report or the Year 1 monitoring report. If it is not possible to complete the removal process during a single period, impervious materials will be removed in stages. The percent of material removed will be documented in the annual monitoring reports.

Construction of the New Trail: Phase 2 project objectives include construction of a New Trail to provide pedestrian access to the habitat areas while maintaining some habitat areas as 'trail-free'. The New Trail will decrease habitat fragmentation by eliminating some sections of existing informal trails. When construction activities are completed, the New Trail will be located on the As-Builts. The New Trail will be documented with photographs which will be included in either the Baseline report or the Year 1 monitoring report. It may be necessary to construct the New Trail and remove old trails in phases. If so, percent completion of the New Trail will be documented in the annual monitoring reports.

Construction of Educational Access Sites on the New Trail: One of the very important goals of the Phase 2 project is to improve educational access. Appropriate active education access sites and nodes will be constructed on the New Trail. These sites will allow students to access water and various habitat types in a manner that does not cause damage to either habitat functions or water quality. When construction activities are completed, the educational access sites will be located in the As-Builts, and will be documented with photographs which will be included in either the Baseline report or the Year 1 monitoring report. As mentioned above, it may be necessary to construct the New Trail in phases. If so, percent completion and locations of the educational access sites will be documented in the annual monitoring reports.

Construction of ADA Access on the New Trail: Portions of the New Trail have been designed to meet state and federal ADA standards. These ADA-accessible sections of the New Trail will be located to facilitate access to appropriate water and habitat areas. When construction activities are completed, the ADA-accessible sections of the New Trail will be included in the As-Builts, and will be documented with photographs which will be included in either the Baseline report or the Year 1 monitoring report. As mentioned above, it may be necessary to construct the New Trail in phases. If so, percent completion and location of the ADA-accessible section of the New Trail will be documented in the annual monitoring reports.

### **3.3 Reporting**

Annual monitoring reports will be prepared and submitted to the City of Seattle, Ecology, and COE staff annually by December 1<sup>st</sup> of each monitoring year. Year 1 monitoring will occur the first year *after* the completion of construction. Because it is unknown if construction will take one or two summer seasons, we have left the initiation of the monitoring schedule open.

It is assumed that monitoring for this project will be required for 10 years by the agencies. We have recommended a reporting schedule of Years 1, 2, 3, 5, 7, and 10. The first three years are critical for maintenance, control of invasives, and establishing appropriate hydrology and vegetation communities. By Year 3 the site should be 'working' appropriately. Years 5 and 7 allow check-ins to ensure that no fundamental changes have occurred, that later seral successional plant installation has been successful, and that communities are maturing as predicted. Year 10 provides a look at 'adolescent' habitat areas: trees will still be in sapling stages and not yet functioning as forest. However, the site should be well on its way towards successful establishment; or the problems will be clear and will be under active adaptive management to be rectified.

## 4.0 REFERENCES

City of Seattle Parks and Recreation Department. 2005. *2005 BMP Manual*.

Ecology. 2004. *Guidance on Wetland Mitigation in Washington State, Part 2*. Ecology, Seattle District Corps of Engineers, EPA Region 10. Publication # 04-06-013B

Elzinga, C. L. D., W. Salzer, and J. W. Willoughby. 1998. *Measuring and Monitoring Plant Populations*.

Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.

Hruby, T. 2004. *Washington State Wetland Rating System for Western Washington*. Washington State Department of Ecology Publication No. 04-06-025.

Sheldon & Associates, Inc. 2005. *Magnuson Park, Phase 2—Wetland Delineation Report*, Seattle, Washington. Sheldon and Associates, Inc., Seattle, Washington.

Sheldon & Associates, Inc. 2006. *Conceptual Wetland Compensation Plan for Magnuson Park Phase 2 Development*, Seattle, Washington. Sheldon and Associates, Inc., Seattle, Washington.